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Eugene Montalvo
Date: 22 MAY 2007

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	
Den Boer, Johannis Josephus *et al.*	
Serial No. 10/621,823	Group Art Unit: 1725
Filed July 17, 2003	Examiner: Clifford C Shaw
METHOD FOR INTERCONNECTING TUBULARS BY FORGE WELDING	22 May 2007

COMMISSIONER FOR PATENTS
Alexandria, VA 22313-1450

APPEAL BRIEF UNDER 37 CFR 41.37

Dear Sir:

Attorney for Applicant in the above-captioned application hereby submits the following Appeal Brief pursuant of 37 CFR 41.37 following a Final Rejection in an Office Action dated 11 December 2006. The Notice of Appeal under 37 CFR 41.31 was mailed on 12 March 2007, together with a Request for Pre-Appeal Brief Review. The Panel Decision of the Pre-Appeal Brief Review was mailed on 23 April 2007, resetting the time period for filing an Appeal Brief to one month from the mailing date of the Panel Decision.

Please charge the appropriate fee for filing this Brief to our Deposit Account No. 19-1800.

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I. REAL PARTY IN INTEREST

The real party in interest is Shell Oil Company, assignee of record, which is a subsidiary of Royal Dutch Shell plc, a publicly traded company.

II. RELATED APPEALS AND INTERFERENCES

None.

III. STATUS OF CLAIMS

Claims 1 to 14 were presented for examination.

All claims 1 to 14 stand rejected, as determined by the *Notice of Panel Decision from Pre-Appeal Brief Review* mailed 23 April 2007.

All claims 1 to 14 are the subject of the present Appeal.

IV. STATUS OF AMENDMENTS

None.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A. Claim 1

Independent claim 1 and dependent claim 4 are argued separately in this Appeal.

Claim 1 is the only independent claim on Appeal.

Claimed herein is a method of joining heavy duty tubulars. Supported for this may be found in the specification on page 2 lines 32-33. As stated on page 1, lines 6-7, and page 27 lines 16-17, heavy duty tubulars may include oilfield, well and/or other tubulars. Page 27 line 24 to page 28 line 2 exemplify that the heavy duty tubulars may include tubulars that are expanded downhole to a larger diameter; drill pipes of considerable length and twisted many times as a result of the torque transmitted to the drill bit; steam injection and/or other heater pipes which are subject to high thermal expansion. Graphic examples are shown in Fig. 17, at reference numbers 301 and 302; in Fig. 18 at reference numbers 304 and 305; and in Fig. 19 at reference numbers 307 and 308.

Claim 1 has the following limitations:

Limitation 1:

Each of said tubulars has at least one circumferentially non-planar tubular end. Specification on page 3 lines 7-8 states that the tubular ends have a non-planar shape. Page 3 lines 9 to 13 state that it is preferred that the tubular ends have in circumferential direction a complementary shape in order to alleviate forces to the forge welded tubular ends during use of the heavy duty tubular string. Specific examples of non-planar shape include, as specified on page 28 lines 12-14 with reference to Fig. 18, the non-planar ends 306 of the two adjacent pipe sections 304 and 305 having an in circumferential direction sinusoidal shape. Fig. 19 shows two pipe ends 307 and 308 that have non-

planar rotation symmetrical end faces 309 and 312 (see page 28 lines 17-22). Another example, presented on page 28 lines 3-6, are non-planar teethed ends 303 such as illustrated in Fig. 17.

Limitation 2:

A second limitation is the step of joining the tubulars by forge welding. Textual support is provided on page 3 line 1. Forge welding, as stated in the specification on page 1 lines 25-27, involves circumferential heating of the pipe ends that are to be joined, and subsequently pressing the pipe ends together to form a metallurgical bond. According to page 2 lines 5 to 11, forge welding is intended to encompass all techniques which involve circumferential heating of pipe ends and subsequent metallurgical bonding of the heated pipe ends, including welding techniques that are generally known as diffusion welding, friction welding, flash welding and/or butt welding.

Limitation 3:

The claimed method further comprises the step of flushing a reducing flushing gas around the heated tubular ends during at least part of the forge welding operation. This is for example specified on page 3 lines 2-4. A function disclosed on page 3 lines 4-7 of this step is that oxides are removed from the forge welded tubular ends and the amount of oxide inclusions and irregularities between the forge welded tubular ends is limited. According to page 4 lines 8-12 of the specification, the flushing gas may be a non-explosive mixture of a substantially inert gas - such as nitrogen, helium, or argon - and a reducing gas, for example hydrogen.

B. Claim 4

In addition to the limitations of claim 1, claim 4 has the following additional limitations:

Limitation 4:

The heavy duty tubular string is a casing-while-drilling string, as disclosed on page 4 lines 13-14.

Limitation 5:

The casing-while-drilling string carries a drill bit while drilling the hole, as supported in the specification on page 4 lines 14-15.

Limitation 6:

The casing-while-drilling string remains in the hole after completion of the drilling process, as disclosed on page 4, lines 15-16. The casing-while-drilling string may remain in the borehole in an expanded or unexpanded configuration. For instance, as supported on page 27 lines 24 to 26, the heavy duty tubulars may be tubulars which are expanded downhole to a larger diameter and plastically deformed during the expansion process. Or, as supported in the sentence bridging pages 27 and 28 of the specification, they may be heater well casings, steam injection and/or other heater pipes which are subject to high thermal expansion and may be squeezed by the thermal expansion of the surrounding formation and/or subsidence during the production operations.

VI. GROUNDS OF REJECTIONS TO BE REVIEWED UNDER APPEAL

Presented for review on Appeal are the following grounds of rejection:

1. whether claims 1, 2, 4, 6, and 9-14 are unpatentable under 35 USC § 103(a) over Moe (US Pat. 4,736,084) taken with Liady (US Pat. 1,260,690).

VII. ARGUMENT

A. Rejection of Claim 1 Under 35 U.S.C. §103(a) over US Patent 4,736,084 in view of US Patent 1,260,690

Claim 1 and its dependent claims 2, 4, 6, and 9-14 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Moe (US Pat. 4,736,084) taken with Liady (US Pat. 1,260,690. Attorney respectfully submits that the Examiner failed to establish a *prima facie* basis for obviousness.

MPEP 2143 states:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.
>
> The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

A combination of teachings of the prior art can render a claim obvious. However, MPEP 2143.01-II sets forth that:

> The test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art, and all teachings in the prior art must be considered to the extent that they are in analogous arts. Where the teachings of two or more prior art references conflict, the examiner must weigh the power of each reference to suggest solutions to one of ordinary skill in the art, considering the degree to which one reference might accurately discredit another. *In re Young*, 927 F.2d 588, 18 USPQ2d 1089 (Fed. Cir. 1991). (emphasis added)

And MPEP 2143.02-VI sets forth that:

> A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983),... .

Attorney notes the recent U.S. Supreme Court decision, *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. __, __ S.Ct. __, No. 04-1350, would suggest that the standard for establishment of a prima facie case of obviousness under MPEP 2143 has been modified by the Court. First, the court stated that while the teaching, suggestion, motivation (TSM) test may provide insight as to obviousness, its rigid application is improper. Slip op. at 11. It is simply a factor to be considered in an obvious determination. The Court also rejected the notion that a person of ordinary skill attempting to solve a problem would be led only to those elements of the prior art designed to solve the same problem. "[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." Slip op. at 16.

The Court also noted that in certain circumstances, where there are a known number of identified, predictable solutions, it would be obvious to try one or more of these solutions, negating patentability. Lastly, the Court noted, that while courts and patent examiners must guard against the application of hindsight, the rigid application of rules and standards should not be substituted for common sense. Slip op. at 17.

Nonetheless, the Court stated that there must be some explicit analysis that would cause one of ordinary skill in the art to combine the known elements in a manner claimed in the application. Slip op. at 14. Attorney notes that Deputy Commissioner Focarino, in a letter dated May 3, 2007, has issued instructions to the Technical Center Directors that in order to make a prima facie case of obviousness under §103(a), "it remains necessary to identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claimed."

Attorney respectfully submits that the Examiner failed to make a prima facie showing of obviousness under MPEP 2134 and the guidance set forth in *KSR*.

In numbered paragraph 3 of the Office Action mailed 11 December 2006, the primary reference in the rejection, Moe, is stated to disclose a method of joining tubulars wherein a reducing gas is flushed around the heated tubular ends and the ends of the tubulars are forge welded. Moe does, in fact, disclosure the of a reducing gas to flush the heated ends of tubulars during forge welding operations. Col. 3, lines 36 – 38.

Moe also teaches a specific method of for heating elements are to be joined, especially by forge welding at Col. 1 lines 7-13:

> The present invention relates to a method for heating metal elements to be joined, especially by forge welding, in which the elements are provided with surfaces to be welded and are positioned so that said surfaces constitute a narrow gap, and in which the heating takes place by means of a high frequency current supplied from a power source of alternating current.

Further, at Col. 2 lines 31-37:

> The reason why the current follows the gap surfaces is meant to relate to the fact that the high frequency current does not choose the path of less ohmic resistance, but the path given the lowest total impedance. Consequently it is important that the gap surfaces are positioned close to each other, but without being in physical contact with each other.
>
> (Emphasis added).

Thus, Moe expressly teaches that it is important that the gap surfaces are positioned close to each other, but without being in physical contact with each other. When considering the reference as a whole, Moe's central teaching of providing gap surfaces that are not in physical contact with each other must also be considered. What is also clear is that Moe does not disclose tubular ends with a circumferentially non-planar shape.

The Office Action then states that at the time applicant's invention was made, it would have been obvious to have provided the tubulars in Moe with the ends shapes claims, the motivation being the teachings of Liady that such are useful for welding tubulars in order to produce a stronger weld (see Figs. 1-4 in Liady).

Liady discloses at lines 40-54:

> ...the upper end of this fitting is formed with a series of scallops 13. These scallops are preferably formed with circular gullets and circular teeth of substantially the same are described by the same radius. This will form a reverse curve which continues around the entire end of the pipe. As here shown four teeth 14 are formed, although it will be understood that any suitable number may be used, if desired. The object of this formation is to provide a maximum welding surface and also to permit the teeth to interlock with teeth 15 formed at the end of the pipe 10...

and at lines 77-86:

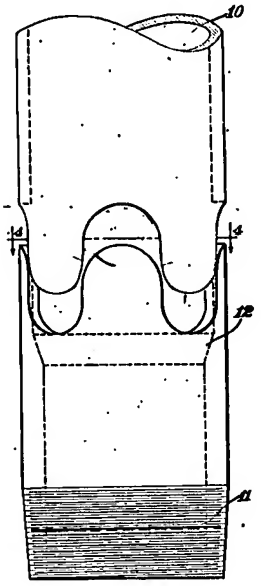
> When the threaded end of-a pipe 10 is broken the remaining fractured portion is machined away and teeth 15 are formed by a suitable cutter into the shape previously described. The pipe fitting 12, which has previously been manufactured, is applied to the specially prepared pipe end and after being interlocked therewith is welded by means of any suitable welding process, such as oxy-acetylene process and the like.

Thus, Liady first interlocks the pipe ends before heating. Interlocking before heating implies bringing the pipe ends into physical contact with each other before heating. According to the Merriam Webster on-line dictionary, "to interlock" can be an intransitive verb meaning "to become locked together or interconnected" or a transitive verb meaning "(1) to lock together - to unite; and (2) to connect so that the motion or operation of any part is constrained by another." This is consistent with the welding process mentioned in Liady - oxy-acetylene welding - which requires a physical contact between the work pieces during heating.

As Liady requires interlocking pipe ends, implying physical contact and Moe requires a gap between the two pipe ends to be joined, Moe does not teach a suitable welding/heating method for Liady's interlocking pipe welds. Examiner has not addressed this incompatibility in the art and failed to make a *prima facie* case of obviousness

The Examiner argues, despite the incompatibility set forth above, a person of ordinary skill in the art would have considered applying Liady's pipe ends to Moe's heating technique anyway. This is despite Liady's teaching on heating the ends after they brought into contact. If one were to attempt maintain the gap required for heating,

as taught by Moe and Liady's end shapes, the person of ordinary skill in the art would have been faced with applying a current through the following arrangement (based on Figs. 1 and 2 taken from Liady):



A large circumferential variation is gap width is observed, and, as will be explained now, for that reason the person of ordinary skill in the art would be taught away from combining Liady with Moe.

Moe teaches away[1] from this arrangement. In particular, in Col. 3 lines 28-31 Moe teaches:

> The fact that the current follows the gap surfaces 4 and 5 very accurately, results in that the resistance heating takes place just at the desired locations.

and at Col. 3 lines 44 –53:

> The gap surfaces can for example be shaped so that they diverge somewhat relative to each other in an inwardly radial direction. This is

[1] A reference that "teaches away" from a given combination may negate a motivation to modify the prior art to meet the claimed invention. Further, a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. *Ormco Corp. v. Align Tech. Inc.*, 463 F.3d 1299, 1308 (Fed. Cir. 2006). The teaching of a consistent gap in Moe is clearly at odds with the interlocking contact of Liady.

> especially favourable in connection with welding of solid parts, such as rods or bolts. Thus if the gap surfaces of the rods or bolts to be joined are given a somewhat curved shape, which involves that the current will not follow the shortest path across the gap surface between the contacts, but rather spread out over the gap surfaces for heating said surfaces all over.

and Col. 3 lines 60-68:

> The curvature of the gap surfaces allows for a larger distance between the gap surfaces in the area of the common longitudinal axis C of the two elements. Whereas the distance therebetween becomes smaller closer to the peripheral areas of said surfaces.
>
> This variation in distance between the surfaces gives a favourable current distribution across the two gap surfaces, so as to allow for a uniform and concentrated heating thereof.

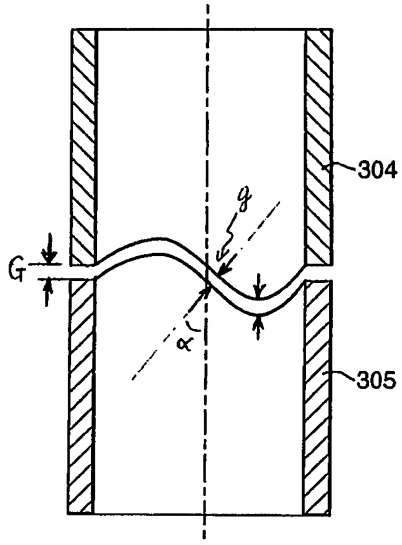
This teaches that variation in the gap width affects the uniformity of heating across the gap surfaces. Moe teaches using radial variations in the gap width to modify the current path to flow in a straight line across the gap surfaces between the contacts and thereby increase the uniformity of heating.

Given the large circumferential variation in the gap width that would be inherently associated with the end shapes of Liady, the skilled person would not be led to apply Liady's end shapes to Moe's heating technique because there would be an expectation that the current distribution – and hence the heating – would be worse instead of better. Moe's teaching even raises doubts regarding the expectation of success of applying Liady's end faces, because with such extreme gap variation the current is not expected to be guided along the gap surfaces such as taught by Moe.

In other words: Moe teaches taking benefit of a radial variation in gap width to improve uniformity of heating, while application of Liady's end shapes cause a circumferential variation in gap width which would be adversely affect uniform heating method taught by Moe.

Not only extreme gullets such as taught by Liady, but any circumferential undulation in the end faces will give rise to increased circumferential variation in gap

width. This is graphically illustrated in the figure below, which shows a gap formed between two sinusoidal end faces as a result of an axial offset *G*.



The resulting gap, generally measured in the direction perpendicular to the local end face, at the extrema is *G*, whereas at the sloped parts of the end faces the gap is $g = G \cdot \cos(\alpha)$, which is always smaller than G.

An examination of Moe demonstrates that it teaches away from using Liady's end shapes and any other circumferential undulation in the end faces, because any undulation will give rise to variation in gap width and therefore adversely affect the heating uniformity, while Moe teaches using radial gap width variation to increase the uniformity.

Attorney respectfully submits that the usefulness of Liady's end shapes for welding tubulars are incompatible with disadvantages regarding variation in gap width that are associated with Moe's heating method.

In the present case, the Examiner has not weighed the power of each reference to suggest solutions to one of ordinary skill in the art, considering the degree to which one reference might accurately discredit another. Instead the Examiner has merely focused on one advantage of Liady.

Therefore, the Examiner has not established a *prima facie* case of obviousness against claim 1 or any of the claims depending on claim 1.

B. Rejection of Claim 4 Under 35 U.S.C. §103(a) over US Patent 4,736,084 in view of US Patent 1,260,690

Dependent claim 4 and its dependent claims 10 and 11 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Moe (US Pat. 4,736,084) taken with Liady (US Pat. 1,260,690).

These references have been applied as in claim 1, and the Office Action of 11 December 2006, under numbered paragraph 3, further states that claims 4, 10, and 11 do not include any further method steps. Instead, according to the *Office Action*, claims 4, 10 and 11 are descriptive of post-weld method scenarios that do not impose any limitation on the claimed subject matter that would distinguish over the combination of prior art references.

In addition to the deficiencies of the rejection as explained above with regard to claim 1, the Examiner has not presented a *prima facie* case of obviousness against claim 4 also for the reason that the prior art references fail to teach or suggest all the claim limitations.

MPEP 2143.03 states:

> To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Claim 4 does impose additional limitations, as set forth in section V above. It is respectfully submitted that none of these limitations are taught or suggested by Moe or Liady, particularly not a casing-while-drilling string nor it remaining in the borehole after completion of a drilling process.

Moe does not provide any suggestion of use of the pipe parts subjected to Moe's heating technique, while Liady aims at replacing pipe ends of worn out drills stems, casings, or pipes to prepare them for re-use. E.g., at lines 86 to 91, Liady discloses:

> After the fitting has been welded to the pipe it may be mounted within the original pipe coupling and will permit the pipe to perform the function for which it was originally intended.

and at lines 92-97 Liady discloses:

> The bodies of the worn out drill stems, casings, or pipes may be softened and weakened by age and still The perfectly good when the new ends are applied, care being taken to produce new ends from new, hard, and strong material.

None of this teaches or suggests the remaining of the pipes inside the borehole after completion of the drilling process.

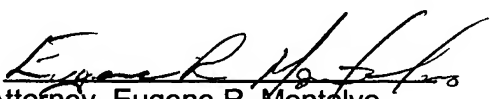
In any case, Examiner has failed to show how Moe and Liady combined teach or suggest these limitations.

Therefore, in addition to the arguments presented above with regard to claim 1, the Examiner has also failed to set forth a *prima facie* case of obviousness of claim 4, or any of the claims depending on claim 4, for reason of failure of the cited references to teach or suggest each claim limitation.

In conclusion of section VII, for the reasons set forth above, the Applicants request that the Board of Appeals overturn the rejections made by the Examiner.

Respectfully submitted,

Johannis Josephus den Boer *et al.*

By: 

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VIII. CLAIMS APPENDIX

1. A method of joining heavy duty tubulars, each of said tubulars having at least one circumferentially non-planar tubular end, the method comprising the step of:

joining the tubulars by forge welding and flushing a reducing flushing gas around the heated tubular ends during at least part of the forge welding operation.

2. The method of claim 1, wherein the tubular ends have an intermeshing regular sinusoidal or teethed shape around the circumference of the tubulars.

3. The method of claim 1, wherein the flushing gas is a non-explosive mixture of a substantially inert gas and a reducing gas, such as a mixture comprising more than 90% by volume of a substantially inert gas, such as nitrogen, helium or argon and more than 2% by volume of hydrogen.

4. The method of claim 1, wherein the heavy duty tubular string is a casing-while-drilling string which carries a drill bit while drilling the hole and which remains in the borehole after completion of the drilling process.

5. The method of claim 1, wherein the tubular ends are heated by passing a high frequency current in circumferential direction through the tubular walls near the tubular ends that are to be joined and wherein the presence of cold spots along the circumference of the heated tubular ends is reduced by arranging a series of longitudinal ferrite bars around the outer surface of the tubular ends and/or within the interior thereof.

6. The method of claim 2, wherein the tubular ends are heated by passing high frequency electrical current through the tubular ends by means of a series of electrodes which are pressed against the inner and/or outer surface of the tubular ends adjacent to the tips of the teeth and/or sinusoidal end faces.

7. The method of claim 1, wherein the tubulars are joined downhole by forge welding after a tube expansion operation and the tubular ends are heated to a forge welding temperature and pressed together whilst a reducing flushing gas is flushed around the heated tubular ends during at least part of the forge welding operation.

8. The method of claim 7, wherein the ends of the tubulars at least partly overlap each other and a forge welding device is inserted into the inner tubular which heats up the tubular ends, flushes a reducing flushing gas into any gap remaining between the overlapping tubular ends and which subsequently presses the outer surface of the heated end of the inner tubular against the inner surface of the outer tubular to join said tubular ends by forge welding, and wherein the end surfaces of the partially overlapping tubular ends are teethed or have a complementary sinusoidal shape in order to alleviate forces to the forge welded expanded tubular ends.

9. The method of claim 1, wherein the flushing gas is flushed around the heated tubular ends such that oxides are removed from the forge welded tubular ends and the amount of oxide inclusions and irregularities between the forge welded tubular ends is limited.

10. The method of claim 4, wherein the casing-while-drilling string remains in the borehole in an expanded configuration.

11. The method of claim 4, wherein the casing-while-drilling string remains in the borehole in an unexpanded configuration.

12. The method of claim 1, wherein prior to joining the tubulars the method comprises a heat-up phase whereby along the entire circumference of the tubular ends a gap of substantially constant width is present during the heat-up phase.

13. The method of claim 1, wherein the non-planar shapes of the tubular ends are complementary.

14. The method of claim 1, wherein the tubular ends have intermeshing regular complementary sinusoidal or teethed shaped end faces around the circumference of the tubulars.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.